ENERGY STAR® FOR RESIDENTIAL LIGHT FIXTURES AND SOLID-STATE LIGHTING LUMINAIRES

QUALITY ASSURANCE TESTING GUIDELINES AND PROCEDURES MANUAL
Version 3.1

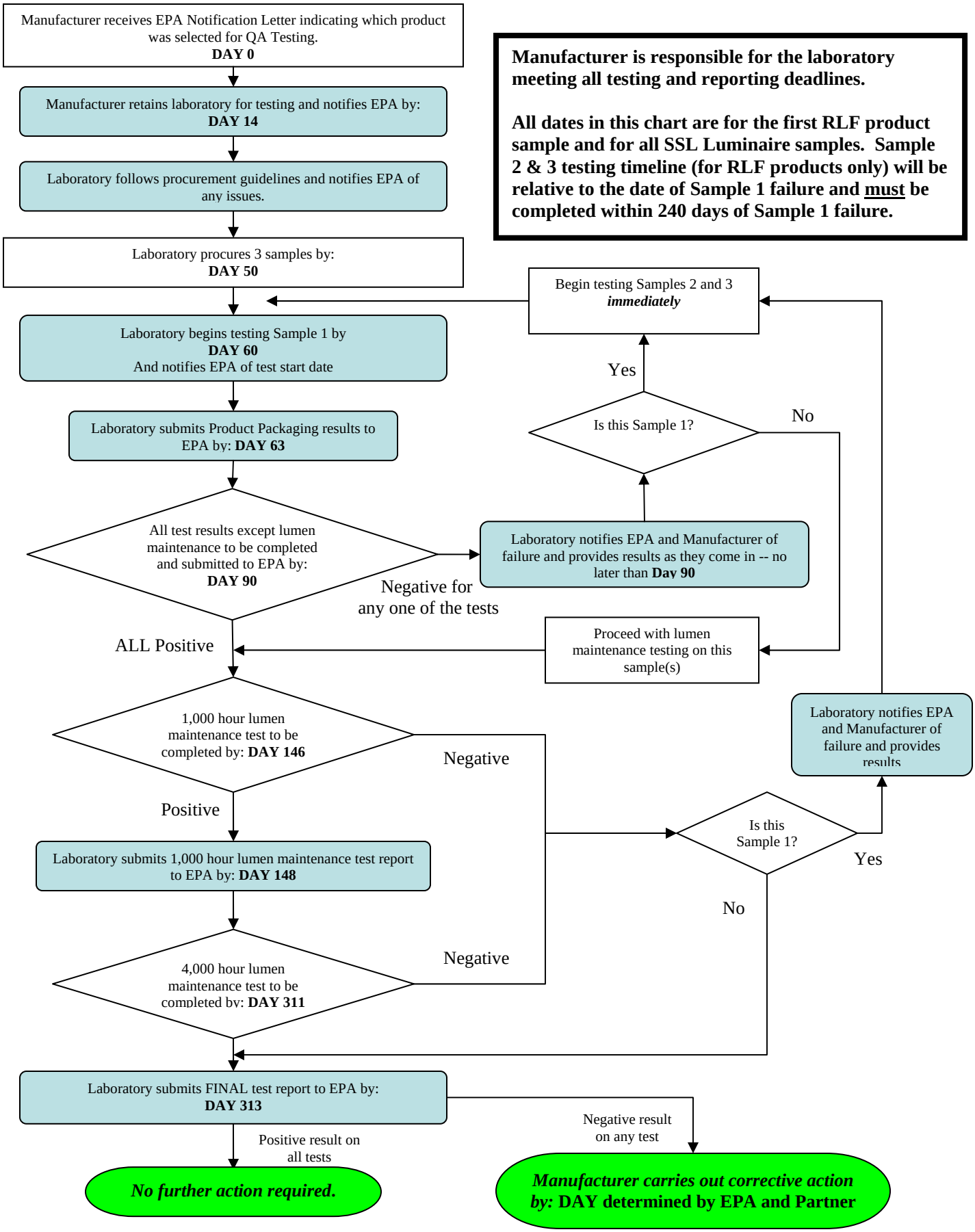
Last Revision: November 3, 2010

TABLE OF CONTENTS

PART ONE: QUALITY ASSURANCE TESTING FOR RESIDENTIAL LIGHT FIXTURES AND SOLID STATE LIGHTING LUMINAIRES*

*For the purposes of this document, products qualified under the ENERGY STAR Program Requirements for Residential Light Fixtures and the ENERGY STAR Program Requirements for Solid-State Lighting Products will be referred to as RLF Products and SSL Luminaires respectively.

RLF Products and SSL Luminaire Quality Assurance Testing
General Summary of Milestones and Reporting Deadlines



Manufacturer is responsible for the laboratory meeting all testing and reporting deadlines.

All dates in this chart are for the first RLF product sample and for all SSL Luminaire samples. Sample 2 & 3 testing timeline (for RLF products only) will be relative to the date of Sample 1 failure and must be completed within 240 days of Sample 1 failure.

Section 1: EPA Selection of RLF Product or SSL Luminaire Manufacturer

1) Product Selection
   a. The Environmental Protection Agency (EPA) may select products for Quality Assurance (QA) testing at any time, but it is anticipated that EPA will select products in batches twice a year.
      i. Initial RLF product (lamp and/or ballast) and SSL luminaire nomination begins with products recommended for testing by EPA, the Department of Energy (DOE), and Energy Efficiency Program Sponsors (EEPS).
      ii. Additional products may be nominated by retailers, designers, homebuilders, manufacturers, or other industry stakeholders.
      iii. Additional products may be selected randomly from the ENERGY STAR Qualified Product list.
      iv. List is rationalized by EPA.
         1. Remove duplicates (multiple private-label versions of the same product).
         2. Address burden on any particular manufacturer (no manufacturer will have more than 2 RLF products with unique lamp/ballast platforms selected for QA testing per year).
         3. Eliminate products for any additional reasons, such as being discontinued by the manufacturer. If EPA selects a product that has been discontinued by the manufacturer, then within 7 days of EPA notification the manufacturer shall notify EPA of this and provide EPA with a complete list of its ENERGY STAR qualified products that are still being manufactured.
   b. EPA shall notify each manufacturer in writing that its product(s) has been selected for QA testing, and provide **14 days**[1] for the manufacturer to contract with a testing laboratory that is accredited as per the requirements in Section 2, below. The 14 days shall begin upon manufacturer receipt of the EPA Notification Letter as verified by express mail delivery notification. An example of the EPA Notification Letter is available in *Appendix B*.
   c. The manufacturer shall notify EPA within 5 days of initial notification if a product selected for QA testing is not currently ENERGY STAR qualified or being manufactured, and supply EPA with an updated, complete list of products that are currently ENERGY STAR qualified and being manufactured.

Section 2: Manufacturer Selection of Testing Laboratory

The manufacturer must retain an accredited testing laboratory and notify EPA within **14 days** of the date of receipt of the EPA Notification Letter. The **manufacturer** must also provide the laboratory with a list of locations and contact information where products may be purchased.

1) Within **14 days** from the date of receipt of the EPA Notification Letter, the Partner shall retain an accredited testing laboratory, authorize the laboratory to share all test data and results with EPA, and notify EPA[2] it has done so.

   In order to conduct QA testing to determine whether a product meets ENERGY STAR requirements, the product must be tested in a laboratory that is accredited by an accreditation body that is a signatory, in good standing, to the International Laboratory Accreditation Cooperation (ILAC), Asia Pacific Laboratory Accreditation Cooperation (APLAC), or National Cooperation for Laboratory Accreditation (NACLA) Mutual Recognition Arrangement (MRA), that verifies, by evaluation and peer assessment, that its signatory members are in full compliance with ISO/IEC 17011 and that their accredited laboratories comply with

[1] All timeframe data is to be considered in calendar days. If a reporting date falls on a weekend or holiday then the required information must be reported on the next business day.
[2] In all cases throughout this document, unless otherwise indicated, the laboratory shall send all communications to EPA or its contractor at RLF@icfi.com. Any reference to sending deliverables to EPA shall be read to include EPA's contractor.

ISO/IEC 17025. One such accrediting body is the National Voluntary Laboratory Accreditation Program (NVLAP).

NOTE: Per ISO/IEC 17025, accredited laboratories must be "able to demonstrate that they are impartial and that the personnel are free from any undue commercial, financial and other pressures which might influence their technical judgment." Where the accredited "laboratory is part of a larger organization, the organizational arrangements should be such that departments having conflicted interests, such as production, commercial marketing or financing do not adversely influence the laboratory's compliance with the requirements" of the ISO standard.

A laboratory's Scope of Accreditation must reflect its specific competence to carry out the test procedures as outlined in the ENERGY STAR Program Requirements for Residential Light Fixtures or SSL Luminaires. Specific test procedures are described in *Appendix D (Residential Light Fixtures) and E (SSL Luminaires).*

The information below may be used to locate an accredited testing facility:

- For a list of NVLAP accredited laboratories, visit the NVLAP Web site at http://www.nist.gov/nvlap or call (301) 975-4016.
- For a list of signatories to the ILAC MRA, visit the ILAC Web site at www.ilac.org.
- For a list of signatories to the APLAC MRA, visit the APLAC Web site at http://www.aplac.org.
- For a list of signatories to the NACLA MRA, visit the NACLA Web site at www.nacla.net.

2) The manufacturer shall provide the laboratory with the *Test Reporting Template* (Appendix A) at the time of laboratory retention. The manufacturer is responsible for ensuring that the laboratory uses this form to submit results to EPA, via email, within 313 calendar days from the date the manufacturer receives the EPA Notification Letter. EPA will provide the *Test Reporting Template*, including a customized "milestone" reporting calendar to the manufacturer upon manufacturer receipt of the EPA Notification Letter as verified by express mail delivery notification.

3) **The <u>RLF product or SSL Luminaire manufacturer</u> is responsible for the laboratory meeting all deadlines, sending deliverables to EPA or its contractor within the allotted time, and providing accurate and complete reports. Failure by the laboratory or the RLF product or the SSL manufacturer to meet the deadlines or provide accurate and complete reports may result in EPA immediately delisting the RLF product from the ENERGY STAR Qualified Product list.**

4) EPA recommends that manufacturers establish task order agreements with one or more laboratories to expedite both initial qualification and QA testing.

5) The laboratory shall not inform manufacturers where samples are purchased, but laboratories may, at their discretion, include the manufacturer in all other communications between the laboratory and EPA or EPA's contractor.

6) If the testing laboratory determines that it is necessary to issue a deposit invoice and receive payment prior to purchasing the samples, the laboratory shall inform EPA and the manufacturer immediately.
   a. The notice from the laboratory to the manufacturer shall include a specific date that payment is due (no more than 30 days).
   b. The **manufacturer and laboratory** shall inform EPA, via email, of the date that payment is due <u>and</u> the date that payment is received.
   c. The **laboratory and manufacturer shall** notify EPA, via email, if payment is not received from the manufacturer within one day past the due date. EPA, at its discretion, may delist that particular RLF product. EPA will inform the manufacturer of its decision.

7) If the manufacturer refuses to pay for QA testing, then EPA will de-list the Partner's specific product(s) selected for QA testing. This action will include, but may not be limited to, sending a notification letter to the Partner and notifying retailers and utilities that the product has been de-listed.

Section 3: Laboratory RLF product or SSL Luminaire Procurement and Sampling

> The **laboratory** must procure samples **within 50 days** of the date the manufacturer receives the EPA Notification Letter.

1) The **laboratory** shall procure three (3) samples of the RLF product or luminaire **within 50 days** of the date the manufacturer receives the EPA Notification Letter, and notify EPA it has done so.
   a. At the time of laboratory retention, the **manufacturer** shall provide the laboratory with a list of at least three (3) locations where the samples may be purchased. The Partner shall verify at the time it creates this list that the samples to be tested are available from those locations.
   b. The laboratory shall procure three (3) samples of the product from a retailer, E-tailer, or wholesaler. Walk-in, catalog mail order, or online purchases are acceptable. **Within 39 days** of the date the manufacturer receives the EPA Notification Letter, the laboratory will immediately notify EPA via email if it is unable to locate samples on the open market. If it is determined that the samples are not available through third-party distribution, then they may be purchased manufacturer-direct (in this instance, the list of three locations of where to purchase the samples is not required).
   c. The laboratory shall require two-day shipping to ensure the receipt of the samples in a timely manner and minimize the risk of lost or damaged samples.
   d. If the samples are damaged during shipment and the laboratory does not have at least one working sample to start testing, the **laboratory** shall immediately begin the return goods authorization process, order replacements, and inform EPA, via email, of the damage and expected new arrival date. If at least one of the samples is in working order but other(s) are damaged, then the laboratory shall commence testing on sample one and begin the return goods authorization process and order replacements for the other sample(s).
   e. If samples have been ordered but have not arrived at the laboratory within the 50-day deadline, or they are damaged upon receipt, the **laboratory** shall notify EPA, via email, with the details of the cause of the delay.
   f. **While the laboratory is responsible for purchasing the samples, the <u>Partner</u> shall be held accountable for failure to meet the 50-day deadline.** If EPA does not receive detailed notification of the receipt, loss, or damage of samples **within 50 days** of the date the manufacturer receives the EPA Notification Letter, EPA may at its discretion begin delisting the product(s). EPA will inform the manufacturer if such an action takes place.

2) The **manufacturer is responsible for the laboratory procuring the correct product**.
   a. It is recommended that the manufacturer stay in frequent communication with the laboratory to make sure the model procured by the laboratory is the model selected by EPA.
   b. EPA is aware there may be times when multiple versions of the same model available in the market are built to different versions of the ENERGY STAR specification. Upon receipt of the samples, the **laboratory** shall confirm with the manufacturer the date the product was manufactured and inform EPA, via email, of this date.

Refer to NVLAP Handbook 150 (2001 Edition) – Procedures and General Requirements, section 5.7, for further guidelines on sampling procedures.

Section 4: Laboratory Sample Receiving and Handling

(Follow the procedures described in the NVLAP NIST Handbook 150-1 and the steps described below)

> The **laboratory** is responsible for proper receiving and handling in accordance with NVLAP procedures; the **manufacturer** is responsible for meeting all testing and reporting deadlines.

4.1 Reviewing Manufacturer Requirements and Accepting Work Orders.

1) The laboratory will receive a "Test Request" or "Purchase Order" from the manufacturer (via email, fax, or letter) for QA testing.

2) The laboratory shall disclose to the manufacturer any pending staff changes, plans to relocate facilities, or capacity issues.

3) **Qualified laboratory staff shall review the purchase order** for completeness and confirm the following:
   a. The testing requirements, including the methods to be used, are adequately defined, documented and understood.
   b. The laboratory has the capability and resources (personnel, space, and time) to meet the testing and schedule requirements.

4) If the laboratory determines it does not have the capability and/or resources to meet the requirements or schedule, it shall immediately notify the manufacturer and EPA.

5) Any changes to the purchase order after the initial agreement with the laboratory shall be submitted by the manufacturer using a revised purchase order. This revised purchase order is subject to the same review process. In addition, EPA must be informed of any changes.

4.2 Receiving and Sample Identification

1) Upon receiving the samples, the **laboratory** shall place identification labels (e.g., decals) on the lamp, ballast, RLF product, luminaire, accessories, product box/packaging, warranty, and any additional hardware or materials sent with the product. The identification labels shall display one number to indicate the product model and another number to identify the sample number. For example, 18476-1, 18476-2, 18476-3 (model number – sample number).

2) Upon receipt of the three (3) samples, qualified laboratory staff shall inspect the model number and confirm with the manufacturer that it is the same model as on the Purchase Order *and* that EPA selected for QA testing.
   a. Prior to testing, the laboratory shall confirm with the manufacturer that the correct model was received, and that it was manufactured on or after the effective date of the current ENERGY STAR specification. Manufacturers may use date-coding on the product to determine when the product was manufactured.
   b. If the wrong model was received by the laboratory, then:
      i. **the manufacturer and laboratory** shall notify EPA immediately;
      ii. the **manufacturer** shall ensure the laboratory procures the correct model; and,
      iii. if necessary, the manufacturer shall propose corrective action, subject to EPA approval. EPA will grant no extensions to the testing timeline.

3) The laboratory shall inspect the samples for any abnormalities that may render any of the samples unsuitable for testing. If any of the samples are unsuitable for testing, the laboratory shall notify the manufacturer and EPA before proceeding.

4) Samples shall be stored in a secure location under conditions that will not affect their performance.
   a. Samples shall be placed in individual bubble-wrap bags in an organized manner to facilitate easy identification and selection during the testing process. Alternatively, the laboratory may store the samples in their original packaging should the laboratory deem the packaging sufficient protection from damage that would impact test results.
   b. The location where samples are stored shall not have unusual or harsh environmental conditions, and shall be secure, i.e., accessible only by authorized laboratory personnel.

5) Copies of the testing request Purchase Order shall accompany each of the samples through the testing process to ensure requirements are accurately and completely communicated.

6) At the manufacturer's expense, all hardware and packaging of all samples shall be retained by the laboratory for a minimum of 12 months after testing is complete and the final report is submitted to EPA. The manufacturer may direct the laboratory to properly dispose of the samples and therefore avoid the 12-month storage costs by sending written communication to EPA and the laboratory indicating it does not wish to dispute the test results, surrenders its right to do so, and authorizes the laboratory to dispose of the samples.

7) Upon testing completion, the laboratory is required to take adequate measures to make sure that at the end of the 12-month storage period (or earlier, pending manufacturer authorization), all samples and packaging are disposed of in an environmentally responsible manner that at least meets federal, state and local disposal laws.

4.3 Sample Preparation

1) A visual inspection on all 3 samples of the RLF product or SSL Luminaire packaging and lamp labeling is required by the laboratory to determine if the product packaging and lamp labeling requirements are met. The laboratory shall refer to the latest version of the ENERGY STAR specification for the current requirements.

2) The laboratory shall set up and run the Maximum Measured Ballast Case Temperature or In-situ temperature measurement test prior to any disassembly of the RLF product. Setup shall follow UL 1598, Section 11 (acceptable when the thermocouple is placed at the hot-spot location indicated by the ballast manufacturer for fluorescent ballasts and the power supply manufacturer for SSL luminaires,), or as described in Appendix I of the LRC's Durability Testing method available at: http://www.lrc.rpi.edu/programs/lightingTransformation/pdf/durabilityTestingFinalReport.pdf.

3) [3]Laboratory personnel shall disassemble the sample and remove the ballast, socket, and lamp without damage to their individual components. Electrical connections shall be disconnected by laboratory personnel in a manner where they can be easily reconnected without any change in electrical current being supplied to the socket, ballast, and lamp.

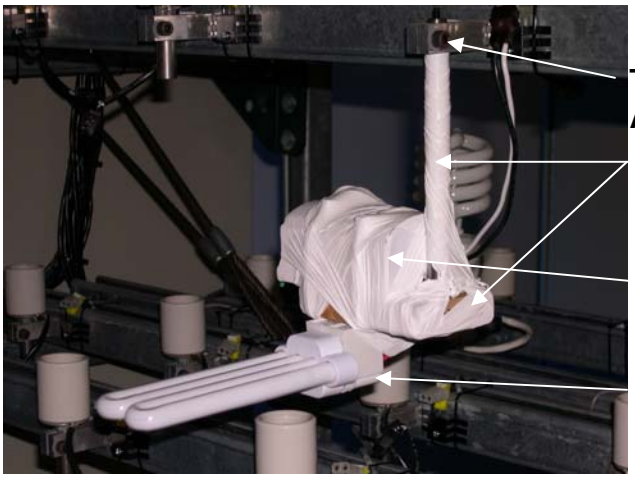
[3] Items 3 through 9 are not applicable to Solid-State Lighting luminaires.

4) Laboratory personnel shall note the designed lamp positioning and orientation inside the RLF product (horizontal, vertical, or degree of tilt). The lamp orientation during the test shall be the same as the intended application or the manufacturer's recommendation.

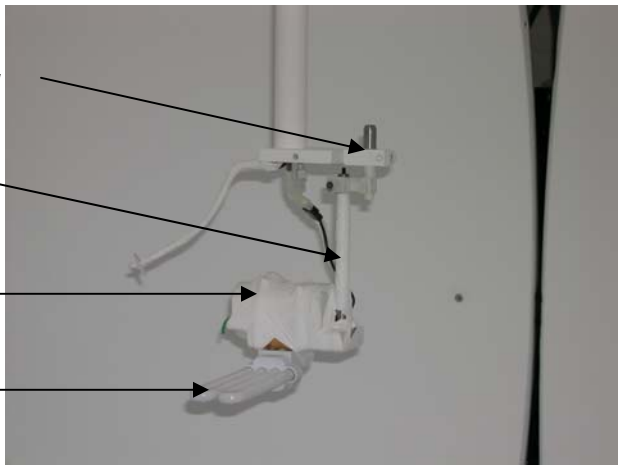
5) If the platform has a GU-24 base, the laboratory shall have GU-24 sockets or GU-24 adapters readily available on the testing and seasoning racks.

6) If the platform s is a lamp and ballast that is hardwired into the RLF product and does not contain a GU-24 base then the **laboratory shall construct a "Platform Holder"** to securely hold the lamp and ballast together during testing and on the seasoning racks.
   a. The Platform Holder may be constructed of different materials but shall be capable of easily moving the platform and securing to the racks and testing equipment with minimal effort. A bar with a thumbscrew can be used to achieve this goal.
   b. The platform may be secured to the platform holder with **white Teflon® tape**. This tape is highly reflective (minimizing light absorption during testing), strong, and easily removable.

Lamp/Ballast and Platform Holder on Seasoning Rack



Lamp/Ballast and Platform Holder in Integrating Sphere



7) Lamp bulbs shall be kept clean of finger prints and any kind of contamination that might interfere with lamp performance. Clean cloth gloves shall be worn by laboratory personnel when handling lamps for testing.

8) Laboratory personnel shall wipe the glass surface of the lamp with a clean soft cloth and alcohol to remove any oils or outside contamination. Dust and debris may be removed with "Dust Off" or a flow of clean air.

9) Laboratory personnel shall season all lamps prior to testing unless otherwise specified. Typically, discharge lamps need 100 hours. Refer to IES LM 54.

10) Laboratory personnel shall maintain the orientation of as it is moved from the aging rack to the testing equipment (e.g. Integrating Sphere). If orientation is disturbed, a pre-burn is required.

Testing shall commence and the laboratory must provide EPA with the testing start date within **60 days** of the date the manufacturer receives the EPA Notification Letter.

Section 5: Sample Testing and Reporting

1) The laboratory shall commence testing and notify EPA of the test start date, via email, **within 60 days** of the date the manufacturer receives the EPA Notification Letter. Notification shall be sent to EPA within 24 hours of the testing start date.

2) The **manufacturer is responsible for the laboratory** providing results of the product packaging and lamp labeling inspection directly to EPA via email **within 63 days** of the date the manufacturer receives the EPA Notification Letter. The laboratory shall attach to its email to EPA digital photograph files of the lamps, SSL luminaires and packaging.

> **The manufacturer** shall have the laboratory provide EPA with the lamp labeling inspection results within **63 days** of the date the manufacturer receives the EPA Notification Letter.

3) For RLF products, the laboratory shall begin performance parameter testing on only one of the samples procured (Sample One), in the following sequence as determined by the type of lamp/ballast under test:[4]

4) For SSL Luminaires, the laboratory shall begin performance parameter testing on all three samples procured in the following sequence.

RLF product Uses GU24 Integrated Lamp(s)	**RLF product Does *Not* Use GU24 Integrated Lamp(s)**	**SSL Luminaires**
Visual Inspection Tests*	Visual Inspection Tests	Visual Inspection Tests
Maximum Ballast Operating Case Temperature During Normal Operation Inside RLF product(s)	Maximum Ballast Operating Case Temperature During Normal Operation Inside RLF product(s)	In-situ Temperature Measurement Test.
Lamp Base*	ANSI or IEC Lamp Base	Maximum power supply temperature§
Efficacy*	Efficacy	Lamp Base if applicable
Color Rendering Index*	Color Rendering Index	Luminaire Efficacy§
Correlated Color Temperature*	Correlated Color Temperature	Color Rendering Index§
Lamp Start Time*	Lamp Start Time	Correlated Color Temperature§
Run-Up Time*	Lumen Maintenance	Zonal Lumen Density§
Lumen Maintenance*		Lumen Maintenance§

**Refer to requirements listed in Table 3 of the ENERGY STAR Residential Light Fixture specification All other requirements pertain to Table 1 of the ENERGY STAR specification.*
§Refer to requirements listed in the Solid-State Lighting Luminaires specification. All SSL Luminaires will be tested for lumen maintenance according to "Option 2" as stated in version 1.2 of the ENERGY STAR SSL criteria using IES LM79-08 and not IES LM80-08.

5) Refer to the version of the ENERGY STAR Program Requirements for Residential Light Fixtures or the ENERGY STAR Program Requirements for Solid-State Lighting Luminaires (referred to as the "ENERGY STAR specifications") that is in effect at the time of initial EPA notification of QA testing for current testing requirements, including the standards and procedures.

[4] Fixtures that are not required to ship with lamps per the ENERGY STAR Residential Light Fixtures specification must still complete testing for all listed performance parameters. The laboratory must purchase the lamps as indicated on/in the fixture packaging. For Solid-State Lighting luminaires all three samples should be tested.

a. For RLF products, the remaining two samples (Sample Two and Sample Three) will be tested only if Sample One fails.
b. Visual Inspection Tests:
    i. For RLF products using GU24 integrated lamps, refer to Table 1 of the ENERGY STAR specification for RLF product packaging requirements and Table 3 of the specification for lamp labeling and additional packaging requirements.
    ii. For RLF products or SSL luminaires using any other lamp type, refer to the appropriate ENERGY STAR specification.

6) **The manufacturer is responsible for the laboratory** sending all test results (except lumen maintenance) directly to EPA **within 90 days** of the date the manufacturer receives the EPA Notification Letter.
    a. The laboratory shall use the *Test Reporting Template* to report the test results. An electronic copy of this form will be provided to the manufacturer with the EPA Notification Letter; the manufacturer shall forward this form to the selected laboratory. See *Appendix A* for a sample.
    b. For RLF products, if results for all tests of Sample One are positive, the laboratory shall inform EPA via email and conduct the lumen maintenance test.
    c. For RLF products, if results for any of the tests of Sample One are negative, the laboratory shall begin testing Samples Two and Three immediately, repeating steps 3 through 7 for BOTH Samples Two and Three.
        i. The laboratory shall send notification to EPA, via email, of the performance parameter that failed, the date of failure, and the date that testing began on the remaining two RLF products. The laboratory shall send this notification **within two days** of the testing start date for Samples Two and Three.
        ii. During QA testing, EPA shall allow a testing variance of ± 3 percent on efficacy and lumen maintenance to account for variability between laboratories (e.g., an efficacy of 48.5 Lm/W would pass an ENERGY STAR required level of 50 since this is 3 percent below the requirement).
        iii. The laboratory shall continue testing Sample One to completion.
        iv. A QA failure occurs when two or three Samples fail to meet the same informational or performance parameter of the ENERGY STAR specification.
    d. For SSL Luminaires, all three samples will be tested upon receipt by the laboratory. The results of each of the three sample tests will be used to determine if a product meets the criteria within the tolerances laid out in Appendix E.

> **The manufacturer** shall have the laboratory provide EPA with the test results (except lumen maintenance) within **90 days** of the date the manufacturer receives the EPA Notification Letter.

7) Lumen Maintenance Test (1,000 hour) – RLF Products Only
    a. The manufacturer shall have the laboratory directly send to EPA the 1,000-hour lumen maintenance test results within 148 days of the date the manufacturer receives the EPA Notification Letter.
    b. Regardless of rated lamp life, lumen maintenance shall be checked at 1,000 hours to ensure that the lamp maintained at least 80 percent of its initial lumen output.
        i. If results for the 1,000 hour lumen maintenance check are positive, the laboratory shall inform EPA via email and continue the lumen maintenance test to completion.
        ii. If results for 1,000 hours of lumen maintenance are negative, the laboratory shall complete the lumen maintenance test on Sample One, and begin testing Samples Two and Three immediately. The laboratory shall repeat steps 3 through 7 for BOTH Samples Two and Three. **Within two**

> **The manufacturer** shall have the laboratory provide EPA with the 1,000-hour lumen maintenance test results within **148 days** of the date the manufacturer receives the EPA Notification Letter.

days of the Sample Two and Three testing start date, the laboratory shall send notification to EPA and the manufacturer, via email, of the performance failure date and the date that testing began on the remaining two RLF products.

8) Lumen Maintenance Test (4,000 hour) – RLF Products Only

> **The manufacturer** shall have the laboratory provide EPA with the 4,000-hour lumen maintenance test results within **311 days** of the date the manufacturer receives the EPA Notification Letter.

   a. **The manufacturer shall have the laboratory directly send to EPA the 4,000-hour lumen maintenance test results within 311 days of the date the manufacturer receives the EPA Notification Letter.**
   b. If results for the 4,000 hour lumen maintenance test are positive, the laboratory shall compile the final report with this and **all** other test results, and submit the final report by email to EPA **within 313 days** of the date the manufacturer receives the EPA Notification Letter (see *Section 6: Submission of Final Report (ALL Tests)*).
   c. If results for the 4,000 hour lumen maintenance test are negative, the laboratory shall immediately repeat steps 3 through 7 for BOTH Samples Two and Three. **Within two days** of the Sample Two and Three testing start date, the laboratory shall send notification to EPA and the manufacturer, via email, of the performance failure date and the date that testing began on the remaining two RLF products.

9) Lumen Maintenance Test (6,000 hour) SSL Luminaires only
   a. **The manufacturer shall have the laboratory directly send to EPA the 6,000-hour lumen maintenance test results within 311 days of the date the manufacturer receives the EPA Notification Letter.**
   b. If results for the 6,000 hour lumen maintenance test are positive, meaning all of the SSL luminaires are found to meet the program requirements, the laboratory shall compile the final report with this and **all** other test results, and submit the final report by email to EPA **within 313 days** of the date the manufacturer receives the EPA Notification Letter (see *Section 6: Submission of Final Report (ALL Tests)*).
   c. If results for the 6,000 hour lumen maintenance test are negative, meaning 1 out of 3 of the SSL luminaires did not meet the program requirements, [5]the laboratory shall compile the final report with this and **all** other test results, and submit the final report by email to EPA **within 313 days** of the date the manufacturer receives the EPA Notification Letter (see *Section 6: Submission of Final Report (ALL Tests)*).

Section 6: Submission of Final Report (ALL Tests)

1) The laboratory shall complete all tests on Sample One, including lumen maintenance testing, **within 313 days** of the date the manufacturer receives the EPA Notification Letter.

> **The manufacturer** shall have the laboratory provide EPA with the FINAL test report within **313 days** of the date the manufacturer receives the EPA Notification Letter.

2) At the time of laboratory retention, the manufacturer shall provide the laboratory with the *Test Reporting Template* (provided to the manufacturer with the EPA Notification Letter). The manufacturer shall ensure that the laboratory uses this form to submit results to EPA, via email, within 313 days of the date the manufacturer receives the EPA Notification Letter.

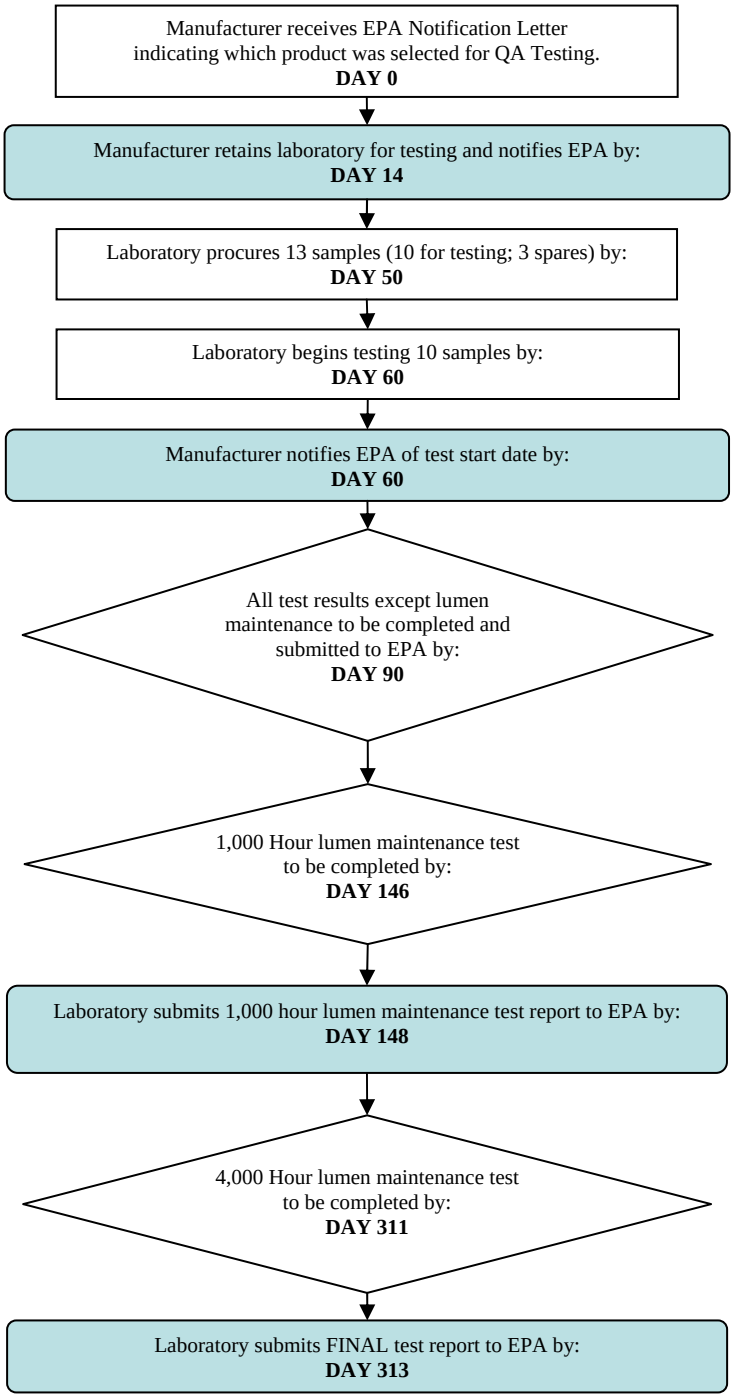
[5] Solid-State Lighting luminaires program requirements are subject to measurement tolerances outlined in tables 2 and 3 of the ENERGY STAR Manufacturer's Guide for Qualifying Solid-State Lighting Luminaires or Appendix E.

3) Failure of the laboratory to submit the final report by the deadline will result in EPA immediately disqualifying the RLF product or SSL luminaire and removing it from the ENERGY STAR Qualified Product list.

4) Failure of two or more RLF product samples to meet the same performance parameter of the ENERGY STAR specification results in a QA failure. Failure of one SSL luminaire sample to meet the same performance parameters of the ENERGY STAR specification results in a QA failure. The tested model, and models with the same lamp/ballast platform as the tested model or members of the same SSL Luminaire product grouping, will be disqualified and removed from the ENERGY STAR Qualified Product list.

PART TWO: QUALITY ASSURANCE TESTING FOR LAMP/BALLAST PLATFORMS

LAMP/BALLAST PLATFORM Quality Assurance Testing
General Summary of Milestones and Reporting Deadlines



The Platform (lamp and/or ballast) Manufacturer is responsible for the laboratory meeting all testing and reporting deadlines.

NOTE: Refer to the procedures on the following pages and Reporting Timeline in the Testing Reporting Template for complete details on deliverables and due dates.

Section 1: EPA Selection of Lamp/Ballast Platform Manufacturer

1) Product Selection
   a. The Environmental Protection Agency (EPA) may select products for Quality Assurance (QA) testing at any time, but it is anticipated that EPA will select products in batches twice a year.
      i. Initial product (lamp and/or ballast) nomination begins with products recommended for testing by EPA, the Department of Energy (DOE), and Energy Efficiency Program Sponsors (EEPS).
      ii. Additional products may be nominated by retailers, designers, homebuilders, manufacturers, or other industry stakeholders.
      iii. Additional lamp/ballast platforms may be selected randomly from the ENERGY STAR Qualified Product list.
      iv. List is rationalized by EPA.
         1. Remove duplicates (multiple private-label versions of the same product).
         2. Address burden on any particular manufacturer (no manufacturer will have more than 2 lamp/ballast platforms selected for QA testing per year).
         3. Eliminate products for any additional reasons, such as being discontinued by the manufacturer.
   b. EPA shall notify each manufacturer in writing that its product(s) has been selected for QA testing, and provide **14 days**[6] for the manufacturer to contract with a testing laboratory that is accredited as per the requirements in Section 2, below. The 14 days shall begin upon manufacturer receipt of the EPA Notification Letter as verified by express mail delivery notification. An example of the EPA Notification Letter is available in *Appendix B*.
      i. **The manufacturer shall notify EPA within 5 days of initial notification if a product selected for QA testing is not currently ENERGY STAR qualified or being manufactured, and supply EPA with an updated, complete list of products that are currently ENERGY STAR qualified and being manufactured.**

Section 2: Manufacturer Selection of Testing Laboratory

1) Within 14 days from the date of receipt of the EPA Notification Letter, the Partner shall retain an accredited testing laboratory, authorize the laboratory to share all test data and results with EPA, and notify EPA[7] it has done so.

   In order to conduct QA testing to determine whether a product meets ENERGY STAR requirements, the product must be tested in a laboratory that is accredited by an accreditation body that is a signatory, in good standing, to the International Laboratory Accreditation Cooperation (ILAC), Asia Pacific Laboratory Accreditation Cooperation (APLAC), or National Cooperation for Laboratory Accreditation (NACLA) Mutual Recognition Arrangement (MRA), that verifies, by evaluation and peer assessment, that its signatory members are in full compliance with ISO/IEC 17011 and that their accredited laboratories comply with ISO/IEC 17025. One such accrediting body is the National Voluntary Laboratory Accreditation Program (NVLAP)

   NOTE: Per ISO/IEC 17025, accredited laboratories must be "able to demonstrate that they are

The manufacturer must retain an accredited testing laboratory and notify EPA within **14 days** of the date of receipt of the EPA Notification Letter. The **manufacturer** must also provide the laboratory with a list of locations and contact information where products may be purchased.

[6] All timeframe data is to be considered in calendar days. If a reporting date falls on a weekend or holiday then the required information must be reported on the next business day.
[7] In all cases throughout this document, unless otherwise indicated, the laboratory shall send all communications to EPA or its contractor at RLF@icfi.com. Any reference to sending deliverables to EPA shall be read to include EPA's contractor.

impartial and that the personnel are free from any undue commercial, financial and other pressures which might influence their technical judgment." Where the accredited "laboratory is part of a larger organization, the organizational arrangements should be such that departments having conflicted interests, such as production, commercial marketing or financing do not adversely influence the laboratory's compliance with the requirements" of the ISO standard.

A laboratory's Scope of Accreditation must reflect its specific competence to carry out the test procedures as outlined in the ENERGY STAR Program Requirements for Residential Light Fixtures. Specific test procedures are described in *Appendix D.*

The information below may be used to locate an accredited testing facility:

a. For a list of NVLAP accredited laboratories, visit the NVLAP Web site at http://www.nist.gov/nvlap or call (301) 975-4016.
b. For a list of signatories to the ILAC MRA, visit the ILAC Web site at www.ilac.org.
c. For a list of signatories to the APLAC MRA, visit the APLAC Web site at http://www.aplac.org.
d. For a list of signatories to the NACLA MRA, visit the NACLA Web site at www.nacla.net.

2) The manufacturer shall provide the laboratory with the *Test Reporting Template* at the time of laboratory retention. The manufacturer is responsible for ensuring that the laboratory uses this form to submit results to EPA, via email, within 313 calendar days from the date the manufacturer receives the EPA Notification Letter. EPA will provide the *Test Reporting Template*, including a customized "milestone" reporting calendar to the manufacturer upon manufacturer receipt of the EPA Notification Letter as verified by express mail delivery notification.

3) **The manufacturer is responsible for the laboratory meeting all deadlines, sending deliverables to EPA or its contractor within the allotted time, and providing accurate and complete reports. Failure by the laboratory or the manufacturer to meet the deadlines or provide accurate and complete reports may result in EPA immediately revoking the platform letter or NEMA/ALA Lamp or Ballast Matrix listing for the lamp and/or ballast being tested.**

4) EPA recommends that manufacturers establish task order agreements with one or more laboratories to expedite both initial qualification and QA testing.

5) The laboratory shall not inform manufacturers where samples are purchased, but laboratories may, at their discretion, include the manufacturer in all other communications between the laboratory and EPA or EPA's contractor.

6) mailto:If the testing laboratory determines that it is necessary to issue a deposit invoice and receive payment prior to purchasing the samples, the laboratory shall inform EPA and the manufacturer immediately.
   a. The notice from the laboratory to the manufacturer shall include a specific date that payment is due (no more than 30 days).
   b. The **manufacturer and laboratory** shall inform EPA, via email, of the date that payment is due and the date that payment is received.
   c. The **laboratory and manufacturer shall** notify EPA, via email, if payment is not received from the manufacturer within one day past the due date. EPA, at its discretion, may delist that particular RLF product. EPA will inform the manufacturer of its decision.

7) If the manufacturer refuses to pay for QA testing, then EPA will revoke the manufacturer platform letter for the specific product selected for QA testing. This action will include, but not be limited to, sending a

revocation letter to the manufacturer and notifying retailers and utilities that the product has been revoked.

Section 3: Laboratory Lamp/Ballast Platform Procurement and Sampling

> The **laboratory** must procure samples **within 50 days** of the date the manufacturer receives the EPA Notification Letter.

1) The **laboratory** shall procure platform samples as follows **within 50 days** of the date the manufacturer receives the EPA Notification Letter, and notify EPA it has done so:
   a. GU24 Integrated Lamp: 18 samples of the platform (10 samples for primary testing, 5 samples for ACTV testing, plus 3 spare samples in case of breakage)
   b. All other platform types: 13 samples of the platform (10 samples for testing plus 3 spare samples in case of breakage).
   c. At time of laboratory retention, the **manufacturer** shall provide the laboratory with a list of at least three (3) locations where the samples may be purchased. The Partner shall verify at the time it creates this list that the samples to be tested are available from those locations.
   d. The laboratory shall procure samples of the platform from a retailer, E-tailer, or wholesaler. Walk-in, catalog mail order, or online purchases are acceptable. When possible, the laboratory shall procure the samples from at least two retail or wholesale sources to acquire products from different manufacturing lots.
   e. **Within 39 days** from the date the manufacturer receives the EPA Notification Letter, the laboratory will immediately notify EPA via email if it is unable to locate samples on the open market. If it is determined that the samples are not available through third-party distribution, then they may be purchased manufacturer-direct (in this instance, the list of three locations of where to purchase the samples is not required).
   f. The laboratory shall require two-day shipping to ensure the receipt of the samples in a timely manner and minimize the risk of lost or damaged samples.
   g. If the samples are damaged during shipment and the laboratory does not have 10 working samples to start testing, the **laboratory** shall immediately begin the return goods authorization process, order replacements, and inform EPA, via email, of the damage and expected new arrival date.
   h. If samples have been ordered but have not arrived at the laboratory within the 50-day deadline, or they are damaged upon receipt, the **laboratory** shall notify EPA, via email, with the details of the cause of the delay.
   i. **While the laboratory is responsible for purchasing the samples, the Partner shall be held accountable for failure to meet the 50-day deadline.** If EPA does not receive detailed notification of the receipt, loss, or damage of samples **within 50 days** of the date the manufacturer receives the EPA Notification Letter, EPA may at its discretion begin delisting the product(s). EPA will inform the manufacturer if such an action takes place.

2) The **manufacturer is responsible for the laboratory procuring the correct product**.
   a. It is recommended that the manufacturer stay in frequent communication with the laboratory to make sure the model procured by the laboratory is the model selected by EPA.
   b. EPA is aware there may be times when multiple versions of the same model available in the market are built to different versions of the ENERGY STAR for Residential Light Fixtures specification. Upon receipt of the samples, the **laboratory** shall confirm with the manufacturer the date the product was manufactured and inform EPA, via email, of this date.

Refer to NVLAP Handbook 150 (2001 Edition) – Procedures and General Requirements, section 5.7, for further guidelines on sampling procedures.

Section 4: Laboratory Sample Receiving and Handling

(Follow the procedures described in the NVLAP NIST Handbook 150-1, as applicable, and the steps described below)

The **laboratory** is responsible for proper receiving and handling in accordance with NVLAP procedures; the **manufacturer** is responsible for meeting all testing and reporting deadlines.

4.1 Reviewing Manufacturer Requirements and Accepting Work Orders.

1) The laboratory will receive a "Test Request" or "Purchase Order" from the manufacturer (via email, fax, or letter) for QA testing.

2) The laboratory shall disclose to the manufacturer any pending staff changes, plans to relocate facilities, or capacity issues.

3) **Qualified laboratory staff shall review the purchase order** for completeness and confirm the following:
   a. The testing requirements, including the methods to be used, are adequately defined, documented and understood.
   b. The laboratory has the capability and resources (personnel, space, and time) to meet the testing requirements and schedule.

4) If the laboratory determines it does not have the capability and/or resources to meet the requirements or schedule, it shall immediately notify the manufacturer and EPA.

5) Any changes to the purchase order after the initial agreement with the laboratory shall be submitted by the manufacturer using a revised purchase order. This revised purchase order is subject to the same review process. In addition, EPA must be informed of any changes.

4.2 Receiving and Sample Identification

1) Upon receiving the samples, the **laboratory shall** place identification labels (e.g., decals) on the lamp, ballast, accessories, product box/packaging, warranty, and any additional hardware or materials sent with the product. The identification labels shall display one number to indicate the product model and another number used to identify the sample number. For example, 18476-1, 18476-2, 18476-3 (model number – sample number).

2) Upon receipt of the samples, qualified laboratory staff shall inspect the model numbers and confirm with the manufacturer that they are the same lamps and/or ballasts as on the Purchase Order *and* that EPA selected for QA testing.
   a. Prior to testing, the laboratory shall confirm with the manufacturer that the correct model was received, and that it was manufactured on or after the effective date of the current ENERGY STAR for RLF specification. Manufacturers may use date-coding on the product to determine when the product was manufactured.
   b. If the wrong model was received by the laboratory, then:
      i. **the manufacturer and laboratory** shall notify EPA immediately;
      ii. the **manufacturer shall ensure** the laboratory procures the correct model; and,
      iii. if necessary, the **manufacturer** shall propose corrective action, subject to EPA approval. EPA will grant no extensions to the testing timeline.

3) The laboratory shall inspect the samples for any abnormalities that may render any of the samples unsuitable for testing. If any of the samples are unsuitable for testing, the laboratory shall contact the manufacturer and EPA before proceeding.

4) Samples shall be stored in a secure location under conditions that will not affect their performance.
   a. Samples shall be placed in individual bubble-wrap bags in an organized manner to facilitate easy identification and selection during the testing process. Alternatively, the laboratory may store the samples in their original packaging should the laboratory deem the packaging sufficient protection from damage that would impact test results.
   b. The location where samples are stored shall not have unusual or harsh environmental conditions, and shall be secure, i.e., accessible only by authorized laboratory personnel.

5) Copies of the testing request Purchase Order shall accompany each of the samples through the testing process to ensure requirements are accurately and completely communicated.

6) At the manufacturer's expense, all hardware and packaging of all samples shall be retained by the laboratory for a minimum of 12 months after testing is complete and the final report is submitted to EPA. The manufacturer may direct the laboratory to properly dispose of the samples and therefore avoid the 12-month storage costs by sending written communication to EPA and the laboratory indicating it does not wish to dispute the test results, surrenders its right to do so, and authorizes the laboratory to dispose of the samples.

7) Upon testing completion, the laboratory is required to take adequate measures to make sure that at the end of the 12-month storage period (or earlier, pending manufacturer authorization), all samples and packaging are disposed of in an environmentally responsible manner that at least meets federal, state and local disposal laws.

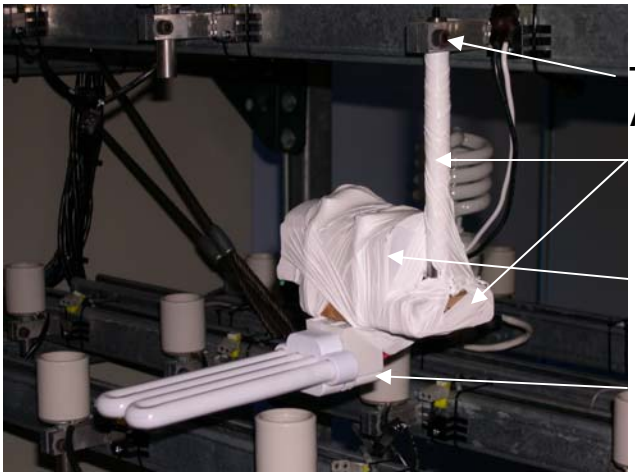
4.3. Sample Preparation

1) For each sample, a complete visual inspection of the lamp is required by the laboratory to determine if the lamp labeling requirement is met. The laboratory shall refer to the latest version of the ENERGY STAR for Residential Lighting Fixture Eligibility Criteria (aka specification) for the current requirement.

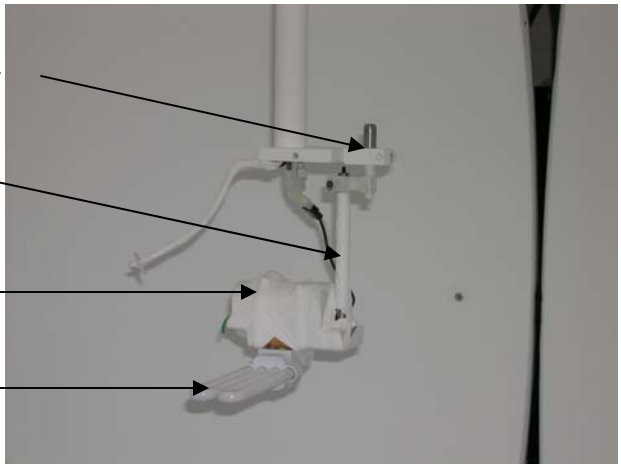
2) If the platform sample has a GU-24 base, the laboratory shall have GU-24 sockets or GU-24 adapters readily available on the testing and seasoning racks.

3) If the platform sample is a lamp and ballast that is hardwired into the fixture and does not contain a GU-24 base then the **laboratory shall construct a "Platform Holder"** to securely hold the lamp and ballast together during testing and on the seasoning racks.
   a. The Platform Holder may be constructed of different materials, but shall be capable of easily moving the platform and securing to the racks and testing equipment with minimal effort. A bar with a thumbscrew may be used to achieve this goal.
   b. The platform may be secured to the platform holder with **white Teflon® tape**. This tape is highly reflective (minimizing light absorption during testing), strong, and easily removable.

Lamp/Ballast and Platform Holder on Seasoning Rack



Lamp/Ballast and Platform Holder in Integrating Sphere



3) Lamp bulbs shall be kept clean of finger prints and any kind of contamination that might interfere with lamp performance. Clean cloth gloves shall be worn when handling lamps for testing.

4) The glass surface of the lamp shall be wiped with a clean soft cloth and alcohol to remove any oils or outside contamination. Dust and debris may be removed with "Dust Off" or a flow of clean air.

5) All lamps shall be seasoned prior to testing unless otherwise specified. Typically, discharge lamps need 100 hours. Refer to IES LM 54.

6) The orientation of lamps shall be maintained as they are moved from the aging rack to the testing equipment (e.g., Integrating Sphere). If orientation is disturbed, a pre-burn is required.

Section 5: Sample Testing and Reporting

1) The laboratory shall commence testing and notify EPA of the test start date, via email, **within 60 days** of the date the manufacturer receives the EPA Notification Letter. Notification shall be sent to EPA within 24 hours of the testing start date. **The laboratory shall test all ten samples simultaneously.**

Testing shall commence and the **laboratory** shall provide EPA with the testing start date within **60 days** of the date the manufacturer receives the EPA Notification Letter.

2) The **manufacturer is responsible for the laboratory** providing results of the lamp labeling inspection (positive or negative) directly to EPA via email **within 63 days** of the date the manufacturer receives the EPA Notification Letter. The laboratory shall attach to its email to EPA digital photographs of the lamps and packaging.

The manufacturer shall have the laboratory provide EPA the lamp labeling inspection results within **63 days** of the date the manufacturer receives the EPA Notification Letter.

3) The laboratory shall test the performance parameters of the ten samples in the following sequence:

GU24 Integrated Lamp(s)	All Other Platform Types
Visual Inspection Tests*	Visual Inspection Tests
Lamp Base*	ANSI or IEC Lamp Base
Efficacy*	Efficacy
ACTV*†	Color Rendering Index
Color Rendering Index*	Correlated Color Temperature
Correlated Color Temperature*	Lamp Start Time
Lamp Start Time*	Lumen Maintenance
Run-Up Time*	
Lumen Maintenance*	

** Refer to requirements listed in Table 3 of the ENERGY STAR specification where marked. All other requirements pertain to Table 1 of the ENERGY STAR specification.*
†Tests to be conducted on 5 separate samples in parallel with other tests.

4) Refer to the version of the ENERGY STAR Program Requirements for Residential Light Fixtures (referred to as the "ENERGY STAR specification") that is in effect at the time of initial EPA notification of QA testing for current testing requirements, including the standards and procedures.
   a. *Visual Inspection Tests*: For fixtures using GU24 integrated lamps, refer to Table 1 of the ENERGY STAR specification for fixture product packaging requirements and Table 3 of the specification for lamp labeling and additional packaging requirements. For fixtures using any other lamp type, refer to Table 1.
   b. *ACTV Testing*: ACTV testing on a separate set of 5 samples shall be conducted concurrently to the other required tests for GU24 Integrated Lamps.

5) **The manufacturer is responsible for the laboratory** sending all test results (except lumen maintenance) directly to EPA **within 90 days** of the date the manufacturer receives the EPA Notification Letter.
   a. The laboratory shall use EPA's QA Testing Report Form to report the test results. An electronic copy of this form will be provided to the manufacturer with the EPA Notification Letter; the manufacturer shall forward this form to the selected laboratory. See *Appendix A* for a sample.
   b. If results for all ten samples are positive, the laboratory shall inform EPA via email and conduct the lumen maintenance test.
   c. If results for any of the ten samples are negative, the laboratory shall inform EPA via email of the performance parameter that failed and the date of failure.
      i. During QA testing, EPA shall allow a testing variance of plus or minus ± 3 percent on efficacy and lumen maintenance to account for variability between laboratories (e.g., an efficacy of 48.5 Lm/W would pass an ENERGY STAR required level of 50 since this is 3 percent below the requirement).
      ii. A QA failure occurs when three out of ten samples fail to meet the same performance parameter of the ENERGY STAR specification (e.g., three out of ten samples fail CRI). A QA failure for the ACTV test occurs when any one of five samples fail to pass the ACTV test.

> **The manufacturer** shall have the laboratory provide EPA with the test results (except lumen maintenance) within **90 days** of the date the manufacturer receives the EPA Notification Letter.

6) Lumen Maintenance Test (1,000 hour)
   a. The manufacturer shall have the laboratory directly send to EPA the 1,000-hour lumen maintenance test

> **The manufacturer** shall have the laboratory provide EPA with the 1,000-hour lumen maintenance test results within **148 days** of the date the manufacturer receives the EPA Notification Letter.

results within 148 days of the date the manufacturer receives the EPA Notification Letter.

b. Regardless of rated lamp life, lumen maintenance shall be checked at 1,000 hours to ensure that the lamp maintained at least 80 percent of its initial lumen output.
   i. If results for the 1,000 hour lumen maintenance check are positive, the laboratory shall inform EPA via email and continue the lumen maintenance test to completion.
   ii. If results for the 1,000 hour lumen maintenance check are negative (three out of ten samples fail), the laboratory shall inform EPA via email and continue the lumen maintenance test to completion.

7) Lumen Maintenance Test (4,000 hour)
   a. **The manufacturer shall have the laboratory directly send to EPA the 4,000-hour lumen maintenance test results within 311 days of the date the manufacturer receives the EPA Notification Letter**.
   b. Regardless of the outcome of the 4,000 hour lumen maintenance test (positive or negative), the laboratory shall compile the final report with this and **all** other test results and submit the final report by email to EPA **within 313 days** of the date the manufacturer receives the EPA Notification Letter (see *Section 6: Submission of Final Report (ALL Tests)*).

The manufacturer shall have the laboratory provide EPA with the 4,000-hour lumen maintenance test results within **311 days** of the date the manufacturer receives the EPA Notification Letter.

Section 6: Submission of Final Report (ALL Tests)

1) The laboratory shall complete all tests, including lumen maintenance testing, **within 313 days** of the date the manufacturer receives the EPA Notification Letter.

2) **At the time of laboratory retention, the manufacturer shall provide the laboratory with the *Test Reporting Template* (provided to the manufacturer with the EPA Notification Letter). The manufacturer shall ensure that the laboratory uses this form to submit results to EPA, via email, within 313 days of the date the manufacturer receives the EPA Notification Letter**.

3) Failure of the laboratory to submit the final report by the deadline will result in EPA immediately revoking the platform letter of approval and/or removing the platform from the NEMA/ALA matrix.

4) Failure of three out of ten samples to meet the same performance parameter of the ENERGY STAR specification results in a QA failure. QA Failure shall result in the platform being considered for corrective action, and EPA immediately revoking its platform letter of approval and/or removing the platform from the NEMA/ALA matrix.

The manufacturer shall have the laboratory provide EPA with the FINAL test report within **313 days** of the date the manufacturer receives the EPA Notification Letter.

Appendix A: Example of Partial Test Reporting Template

I. TEST RESULTS

EPA will provide an electronic copy of the *Test Reporting Template* to each manufacturer upon manufacturer receipt of the EPA Notification Letter as verified by express mail delivery notification. The template will be in Excel. It is the manufacturer's responsibility to make sure the laboratory uses the EPA template for reporting test results.

NVLAP Laboratory Information	
Laboratory Name	
Contact Name	
Phone Number	
Fax Number	
Mailing Address	
Email Address	
Date of Agreement between Laboratory and Manufacturer	
Date Samples Purchased	
Date Sample Testing Began	
Date Sample Testing Completed	
Lamp and/or Ballast Purchasing Information	
Purchase Date	
Purchase Location (city and state)	
Purchased from (Full Company Name)	
Lot Number and/or production date and/or other identifiers	
Consumer Information Parameters	
Lamp Labeling Information (pass/fail)	
Lamp & Ballast Information	
Platform Letter or NEMA/ALA Matrix Listing	
Number of Lamps/Ballast	
Individual Listed Lamp Wattage	
Lamp Type	
Lamp Size	
ANSI or IEC Lamp Base Type	
Lamp Manufacturer	
Lamp Model Number	
Ballast Manufacturer	
Ballast Model Number	
Target CCT (per lamp label)	

Test Results for Combined Lamp & Ballast Requirements			
Lamp & Ballast (Sample)	Luminous Flux (Lumens)	System Power (Watts)	System Efficacy
Sample 1			
Sample 2			
Sample 3			
Sample 4			
Sample 5			
Sample 6			
Sample 7			

APPENDIX B: Quality Assurance FIXTURE Notification Letter

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF

AIR AND RADIATION

Dear XXX:

As you are aware, the *ENERGY STAR® Program Requirements for Residential Light Fixtures (RLF): Version 4.2* includes a Quality Assurance Testing System. The purpose of this letter is to notify you that the Environmental Protection Agency (EPA) has selected XXX fixture model XXX for quality assurance testing.

Per the requirements of the Quality Assurance Testing System XXX shall retain a qualified manufacturer-independent National Voluntary Laboratory Accreditation Program (NVLAP) accredited testing laboratory within **14 calendar days** of this notification (a list of NVLAP accredited, manufacturer-independent laboratories is provided below). XXX shall authorize the laboratory to share all test data and results with EPA. The following performance parameters shall be tested and the following consumer information shall be verified:

Performance Parameters:

System Efficacy
Correlated Color Temperature
ACTV Stress Test
Maximum Mercury Content
Testing Orientation
Lamp Start Time
Color Rendering Index (CRI)
Lumen Maintenance (at both 1,000 hours *and* 4,000 hours)
Run-up Time

Consumer Informational Parameters

- Product Packaging
- Lamp Labeling Information as written on the lamp or lamp base (manufacturer designation that encompasses the lamp manufacturer name, wattage, correlated color temperature, CRI, and labeling for mercury content)
- Fixture Labeling Information as written on the fixture housing for mercury content and disposal awareness

XXX shall provide the laboratory a list of at least three (3) locations of where to purchase three (3) samples on the open market if possible, (walk-in, catalog mail order, or online purchases are acceptable).

The **laboratory** shall procure samples and begin testing **no later than 71 calendar days** from the date this EPA Notification Letter is received. If all performance parameters are met during initial testing, the second and third samples will not be tested, unless the first sample becomes damaged, fails one or more performance parameters, or is otherwise unavailable for testing. If two of three samples fail to meet the same informational or performance parameters of the ENERGY STAR specification, the model and related models, (same integrated GU24 based lamp) will be disqualified and the model will be removed from the ENERGY STAR Qualified Product list.

In addition, XXX is responsible for the lab meeting all deadlines, sending deliverables to EPA or their contractor within the allotted time, and providing accurate and complete reports as defined below *and* in the *Quality*

Assurance Testing Guidelines and Procedures Manual Version 3.0. **Failure by the lab to meet the deadlines or provide accurate and complete reports may result in EPA immediately disqualifying the fixture being tested.**

XXX shall complete the following NEXT STEPS:
Note: all email correspondence to EPA listed below shall be directed to RLF@icfi.com.

1. **Within 14 calendar** days of this notification, commission a third-party, manufacturer-independent, NVLAP accredited testing laboratory and direct the laboratory to begin testing. XXX is required to authorize the laboratory to release all test data and results to EPA. Receipt of this letter by XXX, verified through Express Mail tracking, begins the 14 day count down.
2. Notify EPA, via email, the date that testing begins **within 71 calendar days** from the date of this notification letter. The email shall be sent out within 24 hours of testing start date.
3. Instruct the laboratory to send the consumer informational parameter results (for all three samples) **within 73 calendar days** from this notification letter.
4. Instruct the laboratory to send all test results (except lumen maintenance) directly to EPA, via email, **within 92 calendar days** of this notification letter.
5. Instruct the laboratory to send the 1,000 hour lumen maintenance test results directly to EPA, via email, **within 148 calendar days** of this notification letter.
6. Instruct the laboratory to send the 4,000-hour lumen maintenance test results directly to EPA, via email, **within 311 calendar days** of this notification letter.
7. Instruct the laboratory to send the FINAL test report directly to EPA, via email, **within 313 calendar days** from the date of this notification letter.
8. If the first sample fails any performance parameter, instruct the laboratory to begin testing the second and third samples immediately. The laboratory shall immediately notify EPA via email with the exact date that second and third sample testing began. Testing shall be completed **within 240 calendar days** of the first sample failure.

Attached to this letter is *the Quality Assurance Testing Guidelines and Procedures Manual Version 3.0*. EPA will email the *Test Report Template*, including a customized "milestone" reporting calendar, to XXX upon receipt of this Notification Letter as verified by Express Mail delivery notification. Provide these documents to the manufacturer independent NVLAP accredited laboratory that is performing the tests. Instruct the laboratory to send all correspondence to EPA, via email to RLF@icfi.com.

APPENDIX C: Quality Assurance LAMP/BALLAST PLATFORM Notification Letter

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF AIR AND RADIATION

Dear XXX:

As you are aware, the *ENERGY STAR® Program Requirements for Residential Light Fixtures (RLF): Version 4.2* includes a Quality Assurance Testing System. The purpose of this letter is to notify you that the Environmental Protection Agency (EPA) has selected the following XXX lamp/ballast combinations for quality assurance testing:

	Ballast Manufacturer	Ballast Model Number	Lamp Manufacturer	Lamp Model Number

Per the requirements of the Quality Assurance Testing System, XXX shall retain a qualified manufacturer-independent National Voluntary Laboratory Accreditation Program (NVLAP) accredited testing laboratory by **14 calendar days** of this notification (a list of NVLAP accredited, manufacturer-independent laboratories is provided below). XXX shall authorize the laboratory to share all test data and results with EPA. The following performance parameters shall be tested and the following consumer information shall be verified:

Performance Parameters:

Efficacy
Correlated Color Temperature
ANSI or IEC Lamp Base Type
Lamp Start Time
Color Rendering Index (CRI)
Lumen Maintenance

Consumer Informational Parameters

Lamp Labeling Information as written on the lamp or lamp base (manufacturer designation that encompasses the lamp manufacturer name, wattage, correlated color temperature, and CRI)

XXX shall provide the laboratory a list of at least three (3) locations of where to purchase thirteen (13) samples on the open market if possible, (walk-in, catalog mail order, or online purchases are acceptable) with ten samples used for testing.

The **laboratory** shall procure samples and begin testing ten samples simultaneously **no later than 71 calendar days** from the date this EPA Notification Letter is received. If three out of ten samples fail to meet the same informational or performance parameters of the ENERGY STAR specification, corrective action will be considered including the revocation of the platform's approval.

In addition XXX is responsible for ensuring that the lab meets all deadlines, sends deliverables to EPA or their contractor within the allotted time, and provides accurate and complete reports as defined below *and* in the *Quality Assurance Testing Guidelines and Procedures Manual Version 3.* Failure by the lab to meet the deadlines or provide accurate and complete reports may result in EPA immediately revoking approval of the platform being tested.

XXX shall complete the following next steps:

1. **Within 14 calendar** days of this notification, commission a third-party, manufacturer-independent, NVLAP accredited testing laboratory and direct the laboratory to begin testing. XXX is required to authorize the laboratory to release all test data and results to EPA. Receipt of this letter by XXX, verified through Express Mail tracking, begins the 14 day count down.

2. Notify EPA, via email, the date that testing begins **within 71 calendar days** from the date of this notification letter. The email shall be sent out within 24 hours of testing start date.
3. Instruct the laboratory to send the consumer informational parameter results (for all ten samples) **within 73 calendar days** from this notification letter.
4. Instruct the laboratory to send all test results (except lumen maintenance) directly to EPA, via email, **within 92 calendar days** of this notification letter.
5. Instruct the laboratory to send the 1,000 hour lumen maintenance test results directly to EPA, via email, **within 148 calendar days** of this notification letter.
6. Instruct the laboratory to send the 4,000-hour lumen maintenance test results directly to EPA, via email, **within 311 calendar days** of this notification letter.
7. Instruct the laboratory to send the FINAL test report directly to EPA, via email, **within 313 calendar days** from the date of this notification letter.

Attached with this letter is the *Quality Assurance Testing Guidelines and Procedures Manual Version 3*. EPA will email the *Test Reporting Template,* including a customized "milestone" reporting calendar, to XXX upon receipt of this Notification Letter as verified by express mail delivery notification. Please provide these documents to the manufacturer-independent NVLAP accredited laboratory that is performing the tests. Instruct the laboratory to send all correspondence to EPA, via email to RLF@icfi.com.

APPENDIX D: Summary of Referenced Testing Requirements

Fixtures and Conventional Lamp/Ballast Platforms

Performance Characteristic	ENERGY STAR Requirements	Methods of Measurement Reference Standards
System Efficacy[8] *Per Lamp Ballast Platform in Lumens Per Watt (LPW)*	≥ 50 LPW for all lamp types below 30 total listed lamp watts. ≥ 60 LPW for all lamp types that are ≤ 24 inches and ≥ 30 total listed lamp watts. ≥ 70 LPW for all lamp types that are > 24 inches and ≥ 30 total listed lamp watts.	IESNA LM-9; LM-66; ANSI C82.2
Lumen Maintenance	For lamps indicated on the fixture packaging or shipped with the fixtures, the lamp shall have an average rated lumen maintenance of at least 80% of initial lamp lumens at 40% (4,000 hours minimum) rated lamp life.	IESNA LM-40-01; IESNA LM-9-99; IESNA LM-65-01; IESNA LM-66-00; ANSI C78.5
Color Rendering Index	For lamps shipped with the fixtures, the color rendering index must meet the following requirements: ≥ 80 for compact fluorescent lamps. ≥ 75 for linear fluorescent lamps. If the lamp is not shipped with the fixture, product packaging must meet the requirements set forth in the "Product Packaging for Consumer Awareness" section of this Table.	IESNA LM-58; CIE 13.3
Correlated Color Temperature	For lamps shipped with the fixtures, the lamps must have one of the following designated correlated color temperatures (CCT): 2700K, 3000K, 3500K, 4100K, 5000K, or 6500K. If the lamp is not shipped with the fixture, product packaging must meet the requirements set forth in the "Product Packaging for Consumer Awareness" section of this Table.	IESNA LM-58; LM-16

[8] Efficacy shall be determined with the following equation:

$$\text{Efficacy [Lumens per Watt]} = \frac{\text{Measured Lamp Lumens [Lumens]}}{\text{Measured Input Power [Watts]}}$$

Lamp Lumens: Lamp lumens must be measured using the lamp and ballast that are shipped with the fixture.
Input Power: Input power must be measured with the lamp and ballast that are shipped with the fixture.

Fixtures and Conventional Lamp/Ballast Platforms

Performance Characteristic	ENERGY STAR Requirements	Methods of Measurement Reference Standards
Lamp/ Lampholder Compatibility	For lamps indicated on the fixture packaging or shipped with the fixtures, lamps must utilize an ANSI/IEC standardized lamp base configuration, as defined by ANSI C81.61 and IEC 60061-1. The lampholder must be designed to accept lamps with ANSI/IEC standardized lamp base configurations for all applicable wattages. For example, if the ballast can operate lamps with multiple wattages (e.g., an 18W, 26W, or 32W lamp) then the lampholder must be designed to accept lamps with ANSI/IEC standardized lamp base configurations for all three applicable wattages. In addition**,** lamps shall either: • Meet the requirements of an ANSI/IEC standardized lamp specification sheet, as defined by ANSI C78.901-2001 and IEC 60901 (for compact fluorescent lamps) or ANSI C78.81-2001 and IEC 60081 (for linear lamps) if an applicable standard exists, or, • If no ANSI/IEC lamp standard exists (e.g., a spiral compact fluorescent lamp), a custom lamp specification sheet must be provided at the time of submittal. Specific lamp characteristics that should be included in the lamp specification sheet are detailed in the Required Documentation column.	Lamp Base Configuration: ANSI C81.61; IEC 60061-1 Lamps Compliant with an ANSI-IEC Standard (for lamp dimensions and electrical parameters): ANSI C78.901-2001; ANSI C78.81-2001; IEC 60901; IEC 60081 Lamps Not Compliant with an ANSI-IEC Standard (for lamp dimensions and electrical parameters): ANSI C78.901-2001; ANSI C78.81-2001 (used as a reference for the format and type of information required on a custom lamp specification sheet)
Lamp Labeling Requirement	For lamps shipped with fixtures, a manufacturer designation that encompasses the lamp manufacturer name, wattage, correlated color temperature, and color rendering index must be labeled on the lamp or lamp base.	No Standard Available (Use manufacturer protocol)
Lamp Start Time	The time needed after switching on the lamp to start continuously and remain illuminated must be an average of one second or less.	ANSI C82.11-5.2

Fixtures and Conventional Lamp/Ballast Platforms

Performance Characteristic	ENERGY STAR Requirements	Methods of Measurement Reference Standards
Maximum Measured Ballast Case Temperature During Normal Operation Inside Fixture(s)	Not to exceed the ballast manufacturer maximum recommended ballast case temperature during normal operation inside a fixture. **Note:** This performance characteristic is separate and distinct from thermal requirements established by UL, which governs safety rather than longevity of the ballast. All qualified fixtures are expected to meet this requirement, including linear, suspended, close-to-ceiling, IC, ICAT and Non-IC recessed canisters, etc. as well as those fixtures that may be exempt from UL1598.	UL 1598, Section 11 (Acceptable when the thermocouple is placed at the hot-spot location indicated by the ballast manufacturer.) -OR- Lighting Research Center (LRC) "Proposed Durability Testing Method: Temperature" available at http://www.lrc.rpi.edu/programs/lightingTransformation/pdf/durabilityTestingFinalReport.pdf **Note:** All qualified fixtures are expected to meet the Measured Maximum Ballast Case Temperature During Normal Operation Inside Fixture(s) requirement. This includes every qualified fixture including linear, suspended, close-to-ceiling, IC, ICAT and Non-IC recessed canisters, etc. as well as those fixtures that may be exempt from UL1598.
Dimming	Torchiere style portable fixtures shall be dimmable from 100% to 30%, or less, of maximum light output, or be switchable to three levels of brightness, not including the off position. Other fixture types that utilize dimmable ballasts shall be dimmable from 100% to 30%, or less, of maximum light output, or be switchable to three levels of brightness, not including the off position.	No Standard Available (Use manufacturer protocol)
Product Packaging for Consumer Awareness Requirements	For fixtures that are not shipped with lamps, product packaging must include a list of lamps types that would ensure ENERGY STAR quality and performance when paired with the qualifying fixture. This list must be clearly visible to the consumer on the fixture packaging. Manufacturers are not required to provide specific lamp manufacturer names and model numbers on the packaging. Rather, generic lamp listings, such as the NEMA or ANSI generic descriptions including a color designation (e.g., F32T8/830 or CFQ26W/G24q/827), will suffice. In addition, packaging should suggest that consumers select a lamp with a rated life of 10,000 hours or more. **Note: only recessed downlight fixtures, recessed downlight retrofit kits, and**	No Standard Available (Use manufacturer protocol)

Fixtures and Conventional Lamp/Ballast Platforms

Performance Characteristic	ENERGY STAR Requirements	Methods of Measurement Reference Standards
	fixtures using linear lamps may ship without a lamp. For fixtures that are shipped with lamps, product packaging language is required that clearly describes the nominal color designation of the lamp in units of Kelvin (i.e., 2700K, 3000K, 3500K, 4100K, 5000K, or 6500K). For recessed downlight fixtures that are IC-Rated, product packaging must clearly state this rating. The language must be clearly visible on the product packaging. The IC-Rated designation will also be included in the fixture description included in the Qualified Product list posted on the ENERGY STAR Web site. Sample language: "IC-Rated for direct contact with insulation". For recessed downlight fixtures that are Air-Tight (AT) rated, product packaging must clearly show that the fixture produces less air leakage than 2.0 CFM at 75 Pascals when tested in accordance with ASTM E283. The language must be clearly visible on the product packaging. The "air tight", or similar, designation will also be included in the fixture description included in the Qualified Product list posted on the ENERGY STAR Web site. Sample language: "Certified Air Tight per ASTM E283."	

GU-24 Based Integrated Fluorescent Lamps

Performance Characteristic	ENERGY STAR Requirements	Methods of Measurement Reference Standards
System Efficacy [9] *Per Integrated Lamp in Lumens Per Watt (LPW)*	Bare Lamps: ≥ 50 LPW for all lamp types below 30 total listed lamp watts. ≥ 60 LPW for all lamp types that are ≥ 30 total listed lamp watts. Covered, Reflector, and Dimmable Lamps: ≥ 40 LPW for all lamp types and wattages	LM-66-00; ANSI C78.5
1,000-hour Lumen Maintenance	Must be greater than 90.0% of initial (100-hour) lumen output at 1,000 hours of rated life.	IESNA LM-65-01; IESNA LM-66-00; ANSI C78.5 Section 4.10
Lumen Maintenance at 40% of Rated Life	Must be greater than 80.0% of initial (100-hour) lumen output at 40% of rated life.	
Accelerated Cycling, Thermal, and Voltage (ACTV) stress test	GU-24 must remain functional for 2,880 cycles @ 60°C or 720 cycles at 80 °C	Lighting Research Center (LRC) Test Method
Color Rendering Index	≥ 80	IESNA LM-58; CIE 13.3

[9] Take performance and electrical measurements at the end of the 100-hour aging period according to ANSI C78.5. The lamp efficacy shall be the average of the total sample size for each testing orientation selected for the submittal. Use wattages placed on packaging, not measured wattage, to select proper efficacy category in this table.

Efficacies are based on measured values for lumens and wattages from pertinent test data. Wattages and lumens placed on packages may not be used in calculation and are not governed by this criterion.

GU-24 Based Integrated Fluorescent Lamps

Performance Characteristic	ENERGY STAR Requirements	Methods of Measurement Reference Standards
Correlated Color Temperature	Lamps must have one of the following designated correlated color temperatures (CCT): 2700K, 3000K, 3500K, 4100K, 5000K, or 6500K.	IESNA LM-58; LM-16
Lamp Base	Lamp Base configuration must utilize the GU-24 base.	For details see: http://www.lrc.rpi.edu/gu-24.asp (or ANSI GU-24 standard, upon its release)
Labeling for Replacement GU-24 Lamps *(language printed on integrated lamp base)*	Required lamp labeling language for consumer replacement must include a manufacturer designation that encompasses the following: • lamp manufacturer name • lamp wattage • correlated color temperature • color rendering index Additional packaging requirements for mercury content are included in the **Product Packaging and Lamp Labeling for Consumer Awareness Requirements**, below.	No Standard Available (Use manufacturer protocol – optionally, manufacturer may use the NEMA or ANSI generic lamp description).
Lamp Start Time	The time needed after switching on the lamp to start continuously and remain illuminated must be one second or less.	ANSI C78.5 Section 4.7, for test conditions and methodology
Run-up Time	Non-amalgam: Average of 10 samples tested must be less than 1.0 minute per ANSI C78.5, Section 3.11 and 4.8.	ANSI C78.5, Section 3.11 and 4.8
	Amalgam: Average of 10 samples tested must be less than 3.0 minutes per ANSI C78.5, clause 3.11 and 4.8.	

GU-24 Based Integrated Fluorescent Lamps

Performance Characteristic	ENERGY STAR Requirements	Methods of Measurement Reference Standards
Product Packaging and Lamp Labeling for Consumer Awareness Requirements	Required lamp labeling language for mercury content must include one (1) of the following : • the symbol “Hg” within a circle • “Contains Mercury” Additional information may also be printed as required by applicable state laws. Required lamp product packaging language for mercury content when lamp is not included with a light fixture must include the following: • the symbol “Hg” within a circle • “Contains Mercury” • www.epa.gov/bulbrecycling Alternatively, www.lamprecycle.org may be printed in place of www.epa.gov/bulbrecycling , so long as a prominent hyperlink to the EPA's web site is maintained on the alternate's home page.	No Standard Available (Use manufacturer protocol)
	Required lamp product packaging language for warranty when lamp is not included with a light fixture: Product packaging must state "Warranty" or "Limited Warranty" and have one of the following for consumer complaint resolution (as applicable): • A company phone number; or • mailing address; or • web site address.	No Standard Available (Use manufacturer protocol)
	Required lamp product packaging language for FTC labeling requirements when lamp is not included with a light fixture: ENERGY STAR qualified compact fluorescent lamps and lamp systems must comply with the labeling requirements of the U.S. Federal Trade Commission Packaging Laws - FTC 16CFR Part 305.1-.19.	FTC 16CFR Part 305.1-.19
	Required lamp product packaging language for starting temperature when lamp is not included with a light fixture: Package must state the minimum starting temperatures or geographic zone of use and any other conditions for reliable starting to meet the starting time requirements of ANSI C78.5, clause 4.8.	ANSI C78.5 clause 4.8

GU-24 Based Integrated Fluorescent Lamps

Performance Characteristic	ENERGY STAR Requirements	Methods of Measurement Reference Standards
	Required lamp product packaging language for control compatibility when lamp is not included with a light fixture: Lamp package must clearly state any known incompatibility with photo controls, dimmers or timing devices. In addition, packaging should state specific application exceptions.	No Standard Available (Use manufacturer protocol)
	Packaging language requirement: Packaging and lamp labeling language must be in English or English with additional languages. For products that will be sold in Canada, packaging must include both English & French.	No Standard Available (Use manufacturer protocol)

APPENDIX E: Qualification Tolerances for the SSL Luminaire Program

Table 1 - Required Test Reporting and Tolerance for Solid-State Lighting Luminaires

Performance Metric	Methods of Measurement/Test Procedure	Tolerance
Luminaire Efficacy	IESNA LM-79-08 Section 9.1, 9.2 or 9.3 ANSI C82.2	-3%
Minimum Light Output	IESNA LM-79-08 Section 9.1, 9.2 or 9.3	- 10%
Zonal Lumen Density	IESNA LM-79-08 Section 9.3	See Table 2
Lumen Maintenance	IESNA LM-79-08 Section 9.1, 9.2 or 9.3	None
Color Rendering Index	IESNA LM-79-08 Section 9.1 CIE 13.3-1995 IESNA LM-58	- 2 points of required CRI
Correlated Color Temperature	IESNA LM-79-08 Section 9.1 ANSI C78.377-08	ANSI C78.377 Defined
Power Supply TMP_{PS}	ISTMT ANSI/UL 1598-04, ANSI/UL 153-05	N/A

Table 2 - Zonal Lumen Tolerances

Category A Application	Zonal Lumen Density Requirement			Tolerance (Values below are subtracted from minimum % values on the left)	Method of Measurement
	Zone (bilaterally symmetrical)	Minimum Percentage of Total Lumens	Maximum Percentage of Total Lumens		
Under-cabinet kitchen lighting	0-60°	60%	--	- 5%	IESNA LM-79-08 Section 9.1
	60-90°	25%	--	- 10%	
Under-cabinet shelf-mounted task lighting	0-60°	60%	--	- 5%	
	60-90°	25%	--	- 10%	
Under-cabinet shelf-mounted task lighting (asymmetrical distribution)	60-90°	12.5%		- 3%	
Portable desk task lights	0-60°	85%	--	- 15%	
Recessed, surface, and pendant-mounted downlights	0-60°	75%	--	- 10%	

Cove lighting (asymmetrical distribution)	120 - 150°	35%	--	- 3%	
Surface-mounted luminaires with directional heads	0 - 90°	85%	--	- 3%	
Wall wash luminaires (asymmetrical distribution)	20 - 40°	50%	--	- 3%	
Outdoor wall-mounted porch lights	0-90°	85%	--	- 5%	
Outdoor step lights	0-90°	85%	--	- 10%	
Outdoor pathway lights	0-90°	85%	--	- 10%	
Outdoor pole/arm-mounted decorative luminaires	0-90°	85%	--	- 3%	
	110° and above	--	0%	+ 3%	
Bollards	90 – 110%	--	0 – 15%	+ 3%	
	110° and above	--	0%	+ 3%	